Figure 1: Network Fingerprint Sensor Authentication System

Centralized Authentication Server

TCP/IP Network

Ethernet

N-FPS (1)

N-FPS (2)

.

.

N-FPS (N-1)

.

N-FPS (N)

N > 1
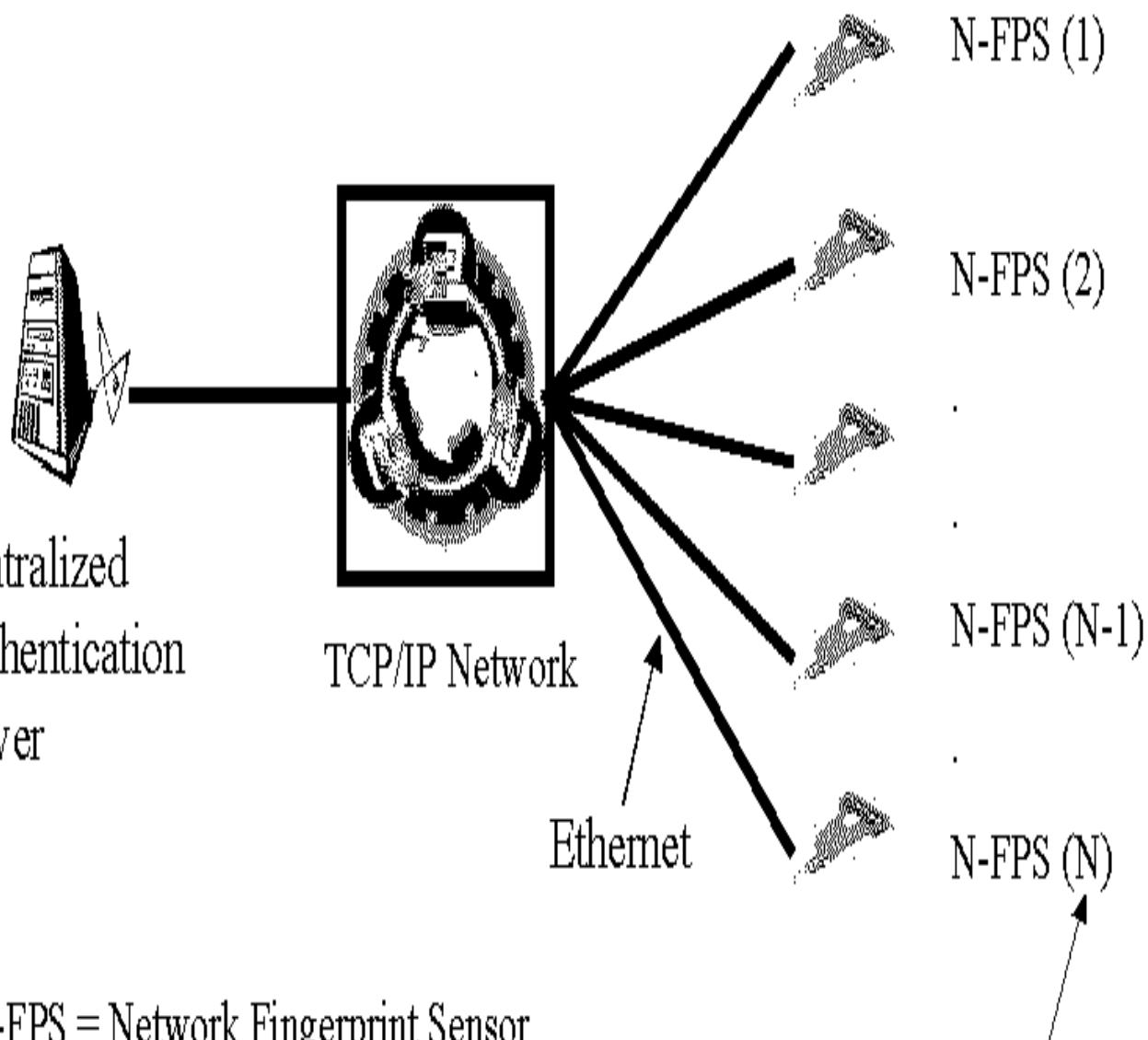
Note: N-FPS = Network Fingerprint Sensor

Note: N-FPS is not connected to a computer. N-FPS does not contain a microprocessor, or a digital signal processor.

Figure 2: Wireless Network Fingerprint Sensor Authentication System

TCP/IP Network

W-NFPS (1)

W-NFPS (2)

.

.

W-NFPS (N-1)

Centralized
Authentication
Server

Wireless
Access Point

Note: W-NFPS = Wireless Network
Fingerprint Sensor

Note: W-NFPS is not connected to a
computer. W-NFPS does not contain a
microprocessor, or a digital signal processor.

802.1x,
BlueTooth

W-NFPS (N)

N > 1
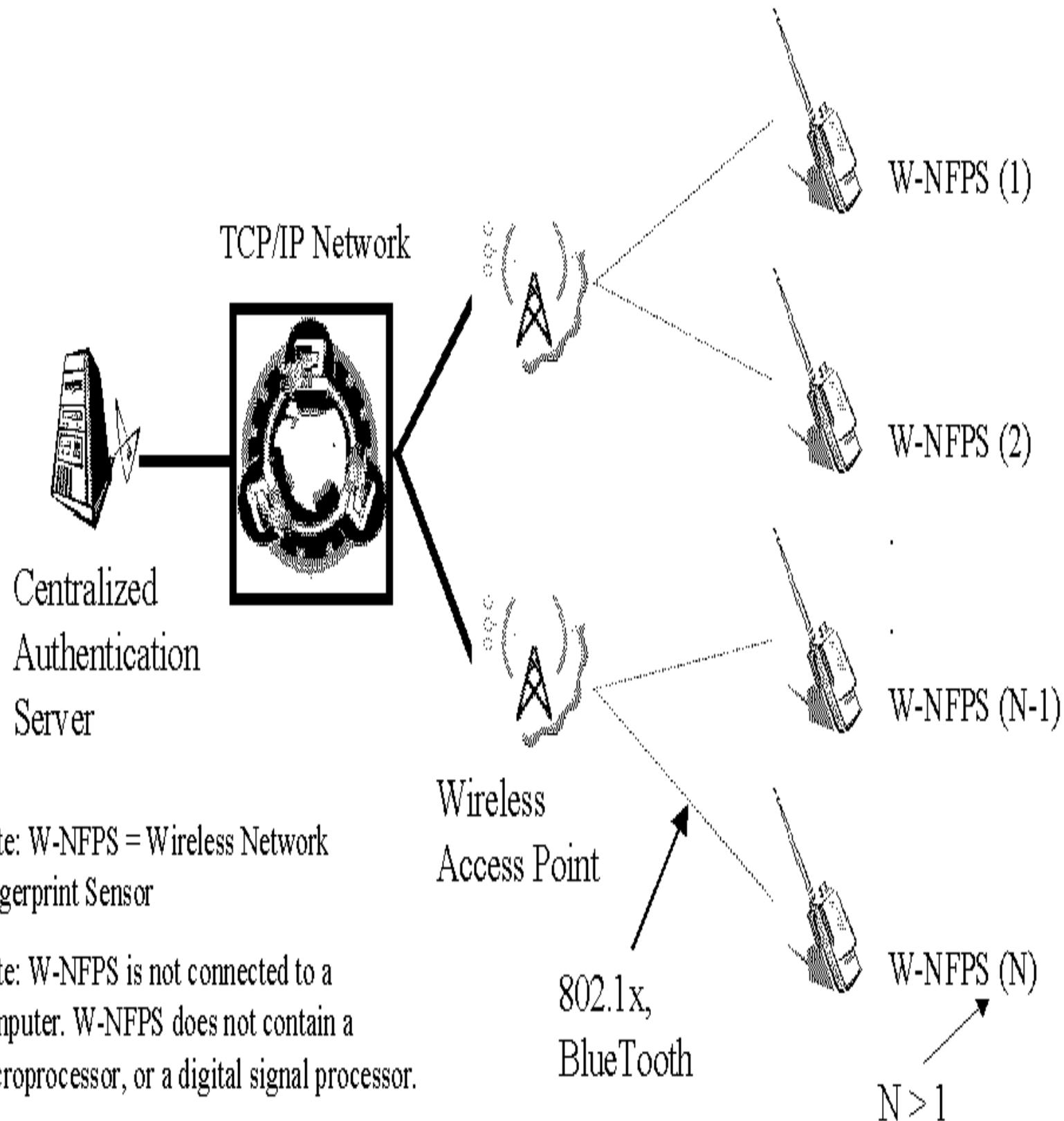
Figure 3: Block Diagram: Network Fingerprint Sensor

Ethernet

Communication IC chip

921.6Kbit UART

Fingerprint IC chip

128Kbyte SRAM
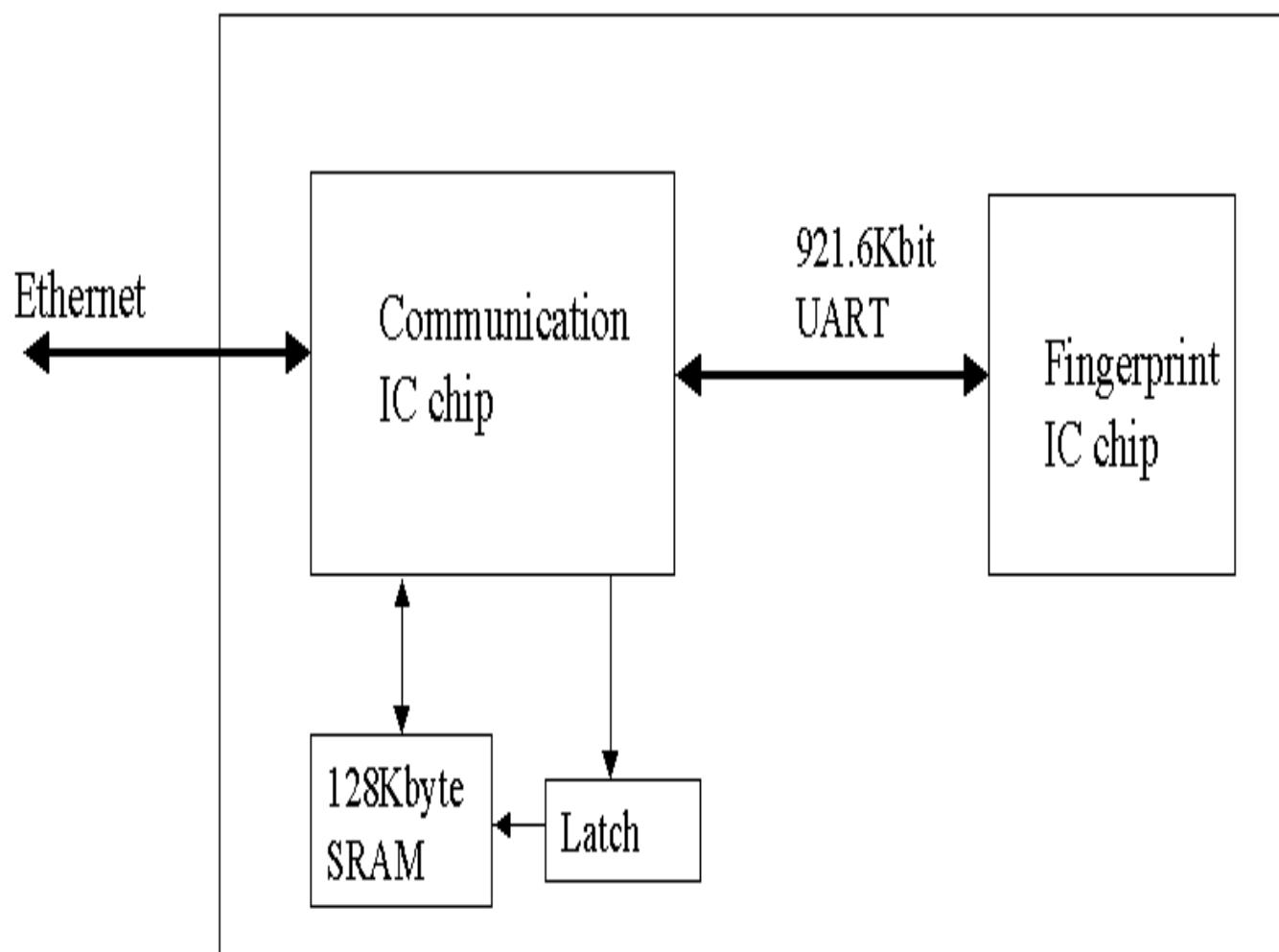
Latch

TCP/IP network communication segment

Fingerprint sensor IC segment

Note: 128Kbyte SRAM and Latch are not required

Figure 4: Block Diagram : Wireless Network Fingerprint Sensor

802.1x,
Bluetooth

Wireless Card

Communication IC chip

921.6Kbit UART

Fingerprint IC chip

128Kbyte SRAM
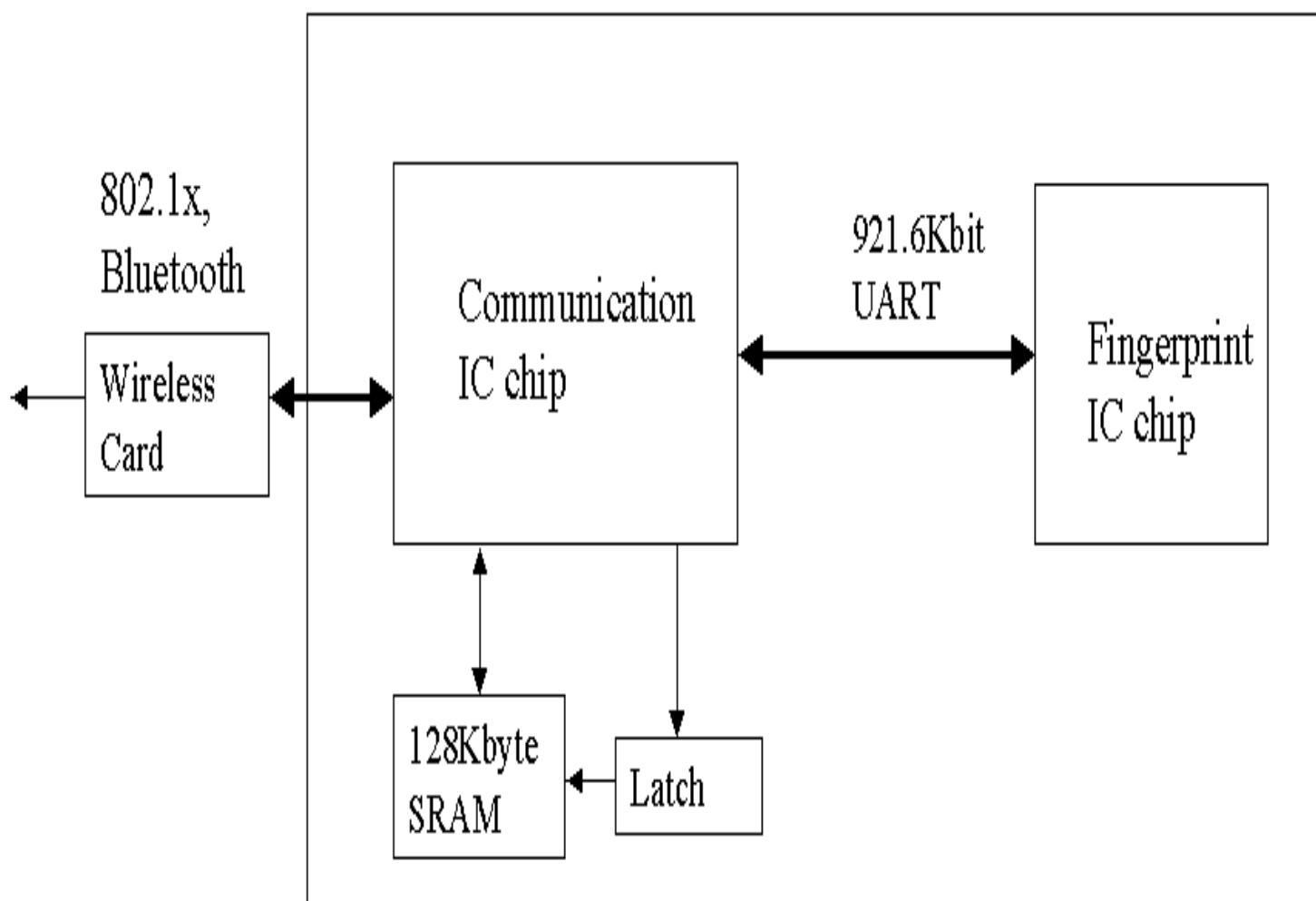
Latch

Wireless network communication segment

Fingerprint sensor IC segment

Note: 128Kbyte SRAM and Latch are not required

Figure 5: Network Fingerprint Sensor Flow Chart

Power up / Reset	**Receive configuration, control, optimization parameters**	**Server needs additional fingerprint data ?**
Auto IP	**Fingerprint data ?**	**Fingerprint authentication result from Authentication Server ?**
Auto authentication server discovery	**AES Encrypt Fingerprint data**	**Perform action based on fingerprint authentication result**
Active TCP open to Authentication Server	**Format encrypted fingerprint data into TCP/IP packet format**	
Encryption Key Exchange with Authentication Server	**Send out TCP/IP packet over Ethernet into network**	

Note: For wireless version, Ethernet is replaced with wireless

Figure 6: Authentication Server Flow Chart

```
┌─────────────────────┐        ┌─────────────────────┐        ┌─────────────────────────┐
│  Power up / Reset   │   ┌───▶│ Send Configuration  │   ┌───▶│ AES decrypt fingerprint │
│                     │   │    │ data                │   │    │ data                    │
└─────────────────────┘   │    └─────────────────────┘   │    └─────────────────────────┘
          │               │              │               │                │
          ▼               │              ▼               │                ▼
┌─────────────────────┐   │    ┌─────────────────────┐   │    ┌─────────────────────────┐
│ Auto server         │   │    │ Send Control        │   │    │ Authenticate fingerprint │
│ announcement        │   │    │ Parameters          │   │    │ data with internal       │
└─────────────────────┘   │    └─────────────────────┘   │    │ database                 │
          │               │              │               │    └─────────────────────────┘
          ▼               │              ▼               │                │
┌─────────────────────┐   │    ┌─────────────────────┐   │                ▼
│ Auto network        │   │    │ Fingerprint         │◀──┐   │    ┌─────────────────────────┐
│ fingerprint sensor  │   │    │ detected ?          │   │No │    │ Format and encrypt       │
│ discovery           │   │    └─────────────────────┘   │   │    │ fingerprint authenticated│
└─────────────────────┘   │         Yes │                │   │    │ result into TCP/IP packet│
          │               │             ▼                │   │    │ format                   │
          ▼               │    ┌─────────────────────┐   │   │    └─────────────────────────┘
┌─────────────────────┐   │    │ Send Optimization   │◀──┐   │                │
│ Multiple passive TCP│   │    │ Parameters          │   │   │                ▼
│ listen to fingerprint│  │    └─────────────────────┘   │   │    ┌─────────────────────────┐
│ sensors connect     │   │             │                │   │    │ Send TCP/IP fingerprint │
│ requests            │   │             ▼                │   │    │ authentication result   │
└─────────────────────┘   │    ┌─────────────────────┐   │No │    │ over Ethernet to network│
          │               │    │ Intermediate        │───┘   │    │ back to network         │
          │               │    │ Fingerprint Sensor  │       │    │ fingerprint sensor      │
          │               │    │ Data OK ?           │       │    └─────────────────────────┘
          │               │    └─────────────────────┘       │
          │               │         Yes │                    │
          ▼               │             ▼                    │
┌─────────────────────┐   │    ┌─────────────────────┐       │
│ Encryption Key      │   │    │ Send optimization   │───────┘
│ exchange with       │───┘    │ parameters and      │
│ network fingerprint │        │ control paramaters  │
│ sensors             │        │ to obtain final     │
└─────────────────────┘        │ fingerprint data    │
                               └─────────────────────┘
```

Always listening

Connect requests received

No

Yes

No

Yes

Figure 7: Communication Flow Chart between Authentication Server and multiple Network Fingerprint Sensors

Authentication Server   Multiple Network Fingerprint Sensors

Auto discovery of network fingerprint sensors→

                        <-Auto discovery of Authentication Server

                        <-Requests TCP connection to socket number

     TCP connection granted->

                        <-Requests encryption key exchange

     Start encryption key exchange->

Send configuration data to network fingerprint sensor->

                        <-Send fingerprint IC configuration identifiers

Fingerprint IC type recognized, send optimization parameters->

     Request fingerprint data if available ->

                        <-Send fingerprint image and template

     Multiple times of send optimization parameters,
     request additional fingerprint image and template ->

                        <-Send additional fingerprint image and template

     Send fingerprint authentication result ->